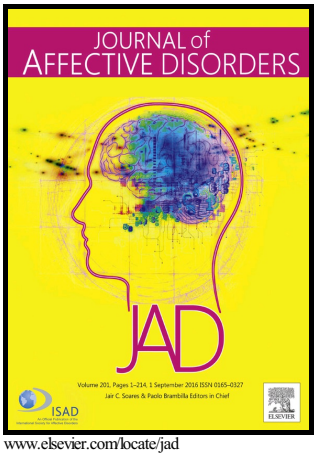

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Physical activity and metabolic disease among people with affective disorders: Prevention, management and implementation

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Abstract

Background

One in ten and one in three of people with affective disorders experience diabetes and metabolic syndrome respectively. Physical activity (PA) and sedentary behaviour (SB) are key risk factors that can ameliorate the risk of metabolic disease among this population. However, PA is often seen as luxury and/or a secondary component within the management of people with affective disorders.

Methods

The current article provides a non-systematic best-evidence synthesis of the available literature, detailing a number of suggestions for the implementation of PA into clinical practice.

Results

Whilst the evidence is unequivocal for the efficacy of PA to prevent and manage metabolic disease in the general population, it is in its infancy in this patient group. Nonetheless, action must be taken now to ensure that PA and reducing SB are given a priority to prevent and manage metabolic diseases and improve wider health outcomes. PA should be treated as a vital sign and all people with affective disorders asked about their activity levels and if appropriate advised to increase this. There is a need for investment in qualified exercise specialists in clinical practice such as physiotherapists to undertake and oversee PA in practice. Behavioural strategies such as the self-determined theory should be employed to encourage adherence. Funding is required to develop the evidence base and elucidate the optimal intervention characteristics.

Conclusion

PA interventions should form an integral part of the multidisciplinary management of people with affective disorders and our article outlines the evidence and strategies to implement this in practice.

The prevalence and burden of metabolic disease in people with affective disorders

People with affective disorders experience an excess mortality rate two to three times higher than the general population (Cuijpers and Smit, 2002, Hayes *et al.*, 2015). This mortality gap translates to a 10-15 year shortened life expectancy (Kessing *et al.*, 2015, Laursen *et al.*, 2016, Ösby *et al.*, 2016). There is an urgent need to tackle the scandal of premature mortality (Thornicroft, 2011). The vast majority (in excess of 70%) of the premature mortality observed in people with affective disorders is due to physical comorbidities, predominantly cardio-metabolic diseases (Wulsin *et al.*, 1999, Laursen *et al.*, 2013). People with affective disorders are at greatly increased risk of metabolic syndrome

(Vancampfort et al., 2013a; Vancampfort et al., 2014) and type 2 diabetes mellitus (T2DM) (Vancampfort et al., 2015a & b). A recent meta-analysis of all of the available worldwide data, demonstrated that almost one third of people with affective disorders meet the criteria for the metabolic syndrome. Specifically, among people with bipolar disorder, 31.7% (95%CI=27.3%-36.3%) have metabolic syndrome, whilst 31.3% (95%CI=27.3%-35.5%) of people with major depressive disorder are affected (Vancampfort *et al.*, 2015a). Compared to the general population people with bipolar disorder (RR=1.58, 95%CI=1.24-2.03) and major depressive disorder (RR=1.57, 95%CI=1.38-1.79) are more likely to have metabolic syndrome. The same meta-analytic report found no significant difference in metabolic syndrome between patients with bipolar disorder and major depressive disorder indicating that both populations are at similar risk (relative risk=0.87; 95% CI=0.48- 1.55; p=0.64;) (Vancampfort *et al.*, 2015a). Unsurprisingly, people with affective disorders also experience high levels of T2DM. Specifically, a recent meta-analysis found that on average 9.2% (95% CI=6.8%-12.4%) of people with bipolar disorder and 6.4% of people with major depression (95%CI=4.8%-8.4%) have T2DM (Vancampfort et al., 2016a). This equated to an increased relative risk of 1.89 (95% CI=1.29-2.77) in people with bipolar disorder and 1.43 (95%CI=0.88-2.25) in people with major depressive disorder respectively.

Physical activity and sedentary behaviour as key risk factors for metabolic disease in people with affective disorders

Factors predisposing people with affective disorders to metabolic disorders include psychotropic medication use (Correll *et al.*, 2015, Vancampfort *et al.*, 2015a) and unhealthy lifestyle factors including a lack of physical activity and a sedentary lifestyle (Janney *et al.*, 2014, Stubbs *et al.*, 2016c). Within the general population, there is evidence that physical activity and exercise are broadly as effective as pharmacological interventions in preventing cardiovascular disease and associated premature mortality (Naci and Ioannidis, 2013). Physical activity is defined here as any interventions that use bodily movement produced by skeletal muscles and which requires energy expenditure while exercise is defined as planned, structured, repetitive and purposive physical activity seeking to improve or maintain physical fitness or health (Caspersen *et al.*, 1985). People with affective disorders engage in low levels of physical activity. For example, in the largest sample to date that used an objective assessment tool (Janney *et al.*, 2014), none of 60 adult outpatients with bipolar disorder

achieved the 150 min/week of moderate to vigorous activity as recommended by the International Organization of Physical Therapists in Mental Health (Vancampfort *et al.*, 2012a). The reason for the lack of physical activity is that people with affective disorders experience a range of barriers to engage in physical activity such as a lower self-efficacy, high levels of somatic co-morbidities, social isolation, and financial strains (Vancampfort et al., 2013b & 2015d).

At the opposite end of the physical activity spectrum, is sedentary behaviour which is defined as an energy expenditure ≤1.5 metabolic equivalents of task (METs), while in a sitting or reclining posture during waking hours (Cart, 2012). In the general population, there is considerable evidence that higher levels of sedentary behaviour is independent from physical activity, associated with an increased risk of diabetes, cardiovascular disease and mortality (Wilmot *et al.*, 2012, Biswas *et al.*, 2015). A cross-sectional study in people with bipolar disorder indicated that those with metabolic syndrome spent significantly more time sitting than those without metabolic syndrome (9.2±3.0 versus 5.8±2.4 hours, P=0.001) (Vancampfort et al., 2016b). A recent meta-analysis (Vancampfort et al., 2016c) demonstrated that people with bipolar disorder spent in total 613.3 min (95%CI=389.9-836.6 min) per day during waking hours sedentary.

Despite the aforementioned, physical activity and sedentary behaviour prevention have received comparatively minimal attention in the literature for improving the health and reducing the burden of metabolic disease among people with affective disorders. There has however been more interest in the mental health benefits of exercise among people with affective disorders. For instance, recent meta-analyses have demonstrated that exercise has a large antidepressant effect among people with depression (Schuch et al., 2016a) and can improve quality of life (Schuch et al., 2016b). Moreover, exercise has also been associated with improved mental health outcomes in bipolar disorder (Melo et al., 2016), although the literature is still relatively sparse.

Whilst physical activity and exercise can have a range of benefits on the health and well-being of people with depression and bipolar disorder, the focus of this article will be on the prevention and management of metabolic disease in this group. The final part will consider how reducing sedentary behaviour and increasing in physical activity and exercise participation can be implemented in daily clinical practice. Specifically, we employ a best-evidence synthesis of the available literature, but have not included a formal systematic review.

Prevention of cardio-metabolic risks in people with affective disorders using physical activity

Cardio-metabolic risk factors are often present in the early stages of the disease among people with affective disorders, including during childhood and adolescence (Goldstein *et al.*, 2015). For this reason, physical activity assessment and counselling should be initiated as early as possible, in particular since adolescents with affective disorders participate in less vigorous physical activity than other adolescents (Jewell *et al.*, 2015). Weight gain and reversal of cardio-metabolic abnormalities are much more difficult to reverse once they have developed; therefore the importance of early preventive interventions is essential. Lifestyle-modification programs are the basis for recent efforts to assist people with affective disorders in improving health and reducing cardio-metabolic risks (Bauer *et al.*, 2016). These programs apply behavioural approaches to weight loss and management, including education and behavioural self-management skills. A meta-analysis (Caemmerer *et al.*, 2012) reported that compared with controls, patients on psychotropic medication following lifestyle interventions including physical activity experienced significant decreases in waist circumference (weighted mean difference, WMD=-3.58 cm, 95%CI=-5.51 to -1.66, p=0.03), percent body fat (WMD=-2.82%, 95%CI:-5.35 to -0.30, P=0.03), fasting glucose (WMD=-5.79 mg/dL, 95%CI= -9.73 to -1.86, P=0.004), insulin (WMD=-4.93 uIU/mL, 95%CI= -7.64 to -2.23, P=0.0004), total cholesterol (WMD=-20.98 mg/dL, 95%CI=-33.78 to -8.19; P=0.001), low density-lipoprotein-cholesterol (WMD=-22.06 mg/dL, 95%CI=-37.80 to -6.32, P=0.006) and triglycerides (WMD=-61.68 mg/dL, 95%CI=-92.77 to -30.59, P=0.0001), and less weight gain of ≥7% (29.7% vs. 61.3%; RR=-0.52, 95%CI=-0.35 to -0.78, P=0.002). Up to 12 months after the intervention ended (mean=3.6 months), benefits endured regarding weight (WMD=-3.48 kg, 95%CI=-6.37 to -0.58, P=0.02). Subgroup analyses showed the superiority of these lifestyle interventions irrespective of whether the intervention was applied in an individual or group setting. Recently, these findings were extended in a large American trial by showing that participants on psychotropic medication (n=104) following a 6-month once weekly (2 hours) combined physical activity and diet counselling program (followed by 6 months maintenance intervention) were 2.39 times as likely as participants in the control group (care as usual) to have normal fasting glucose levels at 12 months (Green *et al.*, 2015). A recent randomized controlled trial in people with depression (Kahl *et al.*, 2016) demonstrated that those (n=20) following a 6-weeks physical activity program, 3 times per week for 45 min at moderate intensity significantly reduced their amount of epicardial adipose tissue

(P=0.017), subcutaneous adipose tissue (P=0.023), weight, (P=0.047), body mass index (P=0.04), high density lipoproteins (P=0.021) and the number of metabolic syndrome risk factors (P=0.018) compared to those having treatment as usual (n=10). To our knowledge, no study has specifically targeted reducing sedentary behaviour among people with affective disorders. Clearly, given the independent adverse impact of sedentary behaviour on metabolic health in the general population (Biswas *et al.*, 2015), established psychosis (Stubbs *et al.*, 2016c) and bipolar disorder (Vancampfort et al., 2016c), there is a need for interventions specifically targeting reducing sedentary behaviour. Interventional and longitudinal studies should explore whether reducing sedentary behaviours can prevent the onset of cardio-metabolic abnormalities in those with affective disorders.

Physical activity in the management of cardio-metabolic risks in people with affective disorders

Once an established diagnosis of metabolic syndrome or T2DM is made, many of those with affective disorders are not offered timely treatment (McGinty *et al.*, 2015). Thus, routine screening and prevention of metabolic abnormalities is only the first step. Those with diagnosed metabolic syndrome or T2DM should be seen regularly by a multidisciplinary team including physicians, nurses, physiotherapists or exercise physiologists and dieticians to advise not just on the metabolic abnormalities but also on other risk factors and medical comorbidities. For example, in smokers promotion of an active lifestyle should go together with quit smoking efforts (Mitchell et al., 2015), while for those with overweight and obesity dietary advice is needed. When metabolic syndrome or T2DM is detected, people with affective disorders are likely to require additional pharmacological management, but this is unlikely to be significantly different from the general population (Holt and Mitchell, 2014).

The importance of risk stratification

Before beginning a lifestyle program including physical activity more vigorous than brisk walking, people with affective disorders should be assessed for conditions that might be associated with increased likelihood of cardiovascular events or that might contraindicate certain types of physical activity or predispose to injury. The patient's age and previous physical activity level should be

considered. The role of maximal incremental exercise testing before beginning a physical activity program is controversial (Gibbons *et al.*, 2002). There is no evidence that such testing is routinely necessary for those planning moderate-intensity activity such as brisk walking, but it should be considered for previously sedentary individuals at moderate to high risk of cardiovascular events who want to undertake vigorous physical activity exceeding clearly the demands of everyday living (Gibbons *et al.*, 2002). It has been recently (Vancampfort et al., 2015e & 2016d) recommended that clinicians and researchers working with people with severe mental illness should apply the American College of Sports Medicine (2009) risk stratification guidelines when assessing the risk of cardiovascular events. Stratification involves determining the presence of absolute and relative contraindications to physical activity including previously diagnosed somatic co-morbidities and physical pain, which are highly prevalent (Stubbs *et al.*, 2015), evaluation of the total number of risk factors, and consideration of signs and / or symptoms suggestive of possible underlying somatic co-morbidities. Within the American College of Sports Medicine (2009) people with affective disorders should be stratified as at low, moderate, or high risk. The stratification of a person with depression or bipolar disorder into the low risk category requires absence of diagnosed cardiovascular or pulmonary disease and no more than one relevant sign and / or symptoms suggestive of underlying cardiovascular, pulmonary, or metabolic disease, whereas the moderate risk designation is appropriate when presenting with two or more risk factors (e.g., pain or discomfort that may be due to ischemia, shortness of breath at rest or with mild exertion, orthopnea, ankle oedema, palpitations or tachycardia). One should be stratified at the high risk level when there is a diagnosis of cardiovascular or pulmonary disease. The American College of Sports Medicine (2009) implies that these guidelines provide only a general recommendation, and physical therapists and exercise physiologists should use their discretion to a certain degree when applying the criteria. Physician involvement is not necessary for low-risk persons with affective disorders performing a submaximal test or commencing a physical activity prescription at moderate or vigorous intensity. For moderate-risk individuals, guidelines recommend a medical examination before prescribing physical activity at a vigorous intensity. For submaximal cardiorespiratory fitness testing and moderate physical activity prescriptions for those at the moderate risk level, physician involvement is not deemed necessary, although it is not discouraged.

The importance of considering side-effects of medication

The large majority of people with affective disorder take psychotropic medication and those with cardio-metabolic risk factors also often beta-blockers. These medications will mostly not interfere with the physical activities people with affective disorders choose to perform, but patients and health care providers should be aware of potential side-effects to minimize their impact (Vancampfort *et al.*, 2012b). In addition, recent meta-analyses have clearly identified that certain antipsychotic medication, particularly clozapine and olanzapine, are associated with an increased risk of metabolic syndrome (Vancampfort et al., 2015c) and type 2 diabetes (Vancampfort et al., 2016a) in people with affective disorders. Other side effects of psychotropic medication include drowsiness of sedation, dizziness, diurnal somnolence, nausea, anhedonia, akathisia, bradykinesia, orthostatic hypotension and headache are few of the many reported side-effects of psychotropic medications (Anderson *et al.*, 2012, Leucht *et al.*, 2013, Kemp, 2014) that might reduce the ability to be physically active. Next to this, health care professionals prescribing physical activity should be aware that beta-blockers can reduce the maximal exercise capacity to 87% of what it would be without beta-blockade (Sigal *et al.*, 1994). However, most people with affective disorders with beta-blockers do not choose to exercise at very high intensity, so this reduction of maximum capacity is generally not problematic but should considered in those wanting to exercise at high intensity.

The importance of considering the right exercise strategies

An outline of potential exercise strategies that can be used to manage metabolic abnormalities in affective disorders are outlined below in the form of a best evidence synthesis.

Aerobic exercise

In the general population there is good evidence that aerobic exercise can reduce the risk of the onset of cardio-metabolic disease (Lin *et al.*, 2015). Among people with affective disorders, the amount and intensity recommended for aerobic exercise vary according to goals (Vancampfort *et al.*, 2012a, Vancampfort *et al.*, 2016a). There is currently no reason to suggest that the current physical activity recommendations for the general population are not feasible for people with affective disorders. In order to improve glycaemic control, assist with weight maintenance, and reduce risk of cardio-metabolic diseases, at least 150 min/week of moderate-intensity aerobic physical activity (40 –60% of

VO_2max or 50–70% of maximum heart rate) and/or at least 75 min/week of vigorous aerobic exercise (>60% of VO_2max or >70% of maximum heart rate) is recommended. Physical activity should be distributed over at least 3 days/week and with no more than 2 consecutive days without physical activity. For long-term maintenance of major weight loss (>13.6 kg/30 lb), larger volumes of exercise (up to 7 h/week of moderate or vigorous aerobic physical activity) may be helpful.

Resistance training

There is promising evidence that resistance training can reduce the metabolic risk profile among the general population (Cornelissen *et al.*, 2011). Among people with affective disorders, in the absence of contraindications, those with metabolic abnormalities should be encouraged to follow the general population recommendations and perform resistance exercise three times a week, targeting all major muscle groups, progressing to three sets of 8–10 repetitions at a weight that cannot be lifted more than 8–10 times. To ensure resistance exercises are performed correctly, maximize health benefits, and minimize the risk of injury, we recommend initial supervision and periodic reassessments by a qualified exercise specialist such as a physiotherapist or exercise physiologist. In people with affective disorders there is evidence for the efficacy of both cardiovascular exercise and resistance exercise, either independently or combined, and this across the range of severity levels and age groups (Stanton *et al.*, 2013).

Some physical activity is better than none

Aerobic exercise and resistance training are not a one-size-fits-all interventions (de Souto Barreto, 2015). Symptoms, previous exercise history, motivation, and access to services all impact on the modality and intensity of exercise that patients will undertake (Vancampfort *et al.*, 2012b). Inexperience with intense physical effort, associated fatigue and discomfort, increased risk of physical injuries, limited availability of exercise facilities and specialized equipment, and cost associated with access to facilities or training can all act as barriers for moderate to vigorous intensity aerobic exercise and resistance training (Vancampfort *et al.*, 2012b). We advocate that those who are unable or unwilling to meet the 150 min of moderate to vigorous intensity physical activity recommendation can still benefit from engaging in some light intensity physical activity (Vancampfort *et al.*, 2015b, Vancampfort *et al.*, 2015c).

Reducing sedentary behaviours in people with affective disorders

The multidisciplinary treatment should also place on emphasis on reducing prolonged sitting and other forms of sedentary behaviour during the waking day. Physical therapists or exercise physiologists should for example support people with affective disorders to limit their recreational screen time (watching television, computer use, playing video games, etc.), time spent sitting during motorized transportation, and time spent sitting in the context of friends or family related activities or during community work (e.g. employment, volunteering). In addition to reducing overall sedentary time, prolonged periods of uninterrupted sedentary time should be minimized by increasing sporadic movements during sedentary time. In practice, this may be achieved by taking brief activity breaks to disrupt prolonged periods of sitting or by increasing movements while sitting (Vancampfort et al., 2015f & g). Future research should however explore if such interventions are efficient in people with affective disorders.

Implementing physical activity interventions in the multidisciplinary treatment of affective disorders

Physical activity should form a central component in the multidisciplinary management of people with affective disorders. Previous research (Soundy *et al.*, 2014) has identified that physical activity is however a low priority in the clinical team for the management of people with mental illness and there needs to be a fundamental shift in attitude from it being a luxury to a necessity. We suggest an outline of how this might be conducted in practice. As indicated previously (Vancampfort 2016e), there is no reason to believe that the multidisciplinary approach should be different than other severe mental ill populations, such as people with schizophrenia. Where possible, we will however indicate some aspects which might be more specific for people with affective disorders.

Physical activity should be considered a vital sign.

Within the general population, there is good evidence that considering physical activity as the fifth vital sign can identify those at increased risk of cardio-metabolic outcomes (Greenwood *et al.*, 2010). Some provisional data among people with established psychosis (Vancampfort et al., 2016f) and bipolar disorder (Vancampfort et al., 2016g) has demonstrated that the Physical Activity Vital Sign (PAVS) method can identify those who are at risk of metabolic abnormalities. The PAVS is a two-question measure to assess the adherence to the international recommendation of 150 minutes per week of moderate to vigorous physical activity (Greenwood *et al.*, 2010). The first question is, "On average how many days per week do you engage in moderate to vigorous physical activity like a brisk walk?" The second question is: "On those days, how many minutes do you engage on average in physical activity at this level?" Next the clinician multiplied the two responses together to calculate the minutes per week of self-reported moderate to vigorous physical activity. In a recent study in people with bipolar disorder, those who did not adhere to the minimum physical activity recommendations as formulated by the PAVS-method had a higher body mass index, performed worse on a walk test, and had a higher risk for abdominal obesity, hypertension, hyperglycemia and metabolic syndrome. The relative risks ranged from 1.33 (0.80-2.21) for having dyslipidemia to 3.39 (1.84-6.24) for metabolic syndrome and 5.33 (2.14-13.27) for hyperglycemia. The brevity of the PAVS, along with the implementation of multidisciplinary care, may help promote the importance of physical activity and exercise assessment and prescription as a core part of the treatment of people with affective disorders. Each member of the multidisciplinary team can play an important role in encouraging people with affective disorders to engage in routine physical activity. For example, in addition to assessing the usual vital signs, nurses could utilize the PAVS-questions while recording the answers in an individual's baseline assessment (Happell *et al.*, 2014). During the subsequent consultation, a psychiatrist could provide positive reinforcement to patients achieving 150 min of physical activity while advising them to maintain their physical activity behaviour. Those patients who are not managing to achieve 150 minutes per week should be advised to become more active and informed about local opportunities such as exercise groups. If time permits, the psychiatrist could briefly explore the patient's readiness for change and use evidence-based behaviour change principles to guide patients toward a more active lifestyle. When time does not permit, or when patients are confronted with severe depressive or manic symptoms and are consequently struggling to be more physically active and/or those who are suffering from cardiovascular, respiratory, neurological or musculoskeletal conditions,

may also benefit from further evaluation by a physical therapist or exercise physiologist (Stubbs *et al.*, 2014). A longitudinal observational cohort systematically collecting PAVS-information during outpatient visits in the general population demonstrated that significant changes in physical activity behaviour and metabolic outcomes (e.g. greater relative weight loss and in patients with diabetes greater relative HbA1c decline) were observed concluding that the PAVS-method represents a valuable first step towards addressing the problem of inadequate physical activity (Grant *et al.*, 2014). A longitudinal study of this nature is currently lacking in people with affective disorders, but would be valuable to see if such metabolic improvements are replicated in this high-risk group. We believe that the PAVS-approach is in particular relevant in those people with bipolar disorder who are in the pre-contemplation stage of change. Recently, a study in people with affective disorders (Vancampfort et al., 2016h) showed that the stage of change model might help to identify patients who are not motivated to initiate or maintain an active lifestyle. The stage of change model (Prochaska and DiClemente, 1992) provides a framework for categorising a person's readiness to change their behaviour and includes five stages. With respect to a change in physical activity behavior, in the first stage, the pre-contemplation phase, individuals are physically inactive and are not thinking about becoming more active within the next six months. During the next contemplation stage, individuals think about becoming more active within the next six months. In the third stage, the preparation stage, individuals are engaging in some physical activity or exercise, while in the penultimate action stage individuals have been regularly active for less than six months. Lastly, the maintenance stage is characterised by sustained regular physical activity or exercise for more than six months.

Qualified exercise professionals including physical therapists should be key members of the multidisciplinary team.

A recent meta-analysis of 37 RCT's reporting dropout rates across 49 exercise interventions including 1,644 people with depression (Stubbs *et al.*, 2016a) demonstrated that supervised interventions delivered by physical therapists and exercise physiologists predict lower dropout. These findings extend calls to ensure that qualified personnel with expertise in physical activity prescription implement physical activity interventions in people with affective disorders (Stanton *et al.*, 2014). Given the marked and often complex physical comorbidity among those with diagnosed with affective disorders including chronic pain (Stubbs *et al.*, 2015) physical therapists and exercise physiologists constitute a

valuable resource to ensure that people with affective disorders acquire the potential benefits of physical activity. **Whilst the worldwide literature has demonstrated that exercise interventions delivered by exercise specialists such as physiotherapists/ exercise physiologists/ sports scientists result in less drop out (Stubbs et al., 2016b) and better outcomes such as cardiorespiratory fitness (Vancampfort et al., 2016), some people with affective disorders do not have ready access to such expertise. For instance, in the U.S., there are funding issues making it difficult for people with mental illness to receive funding/ reimbursement for exercise interventions. There are commendable author groups attempting to increase access to exercise specialists in patient groups with mental illness (Pratt et al., 2016)**.

Physical activity interventions should incorporate behavioural theories.

Behavioural theories such as socio-ecological models are useful in attempting to understand specific barriers to physical activity participation in people with affective disorders (Vancampfort and Faulkner, 2014). Socio-ecological models posit that multiple levels of impact including intrapersonal (e.g. demographic, biological, psychological, cognitive, emotional), interpersonal／cultural (e.g. social support), physical environment (e.g. distance to the facilities, low program cost, enjoyable scenery, neighbourhood safety and the presence of sidewalks) and policy (e.g. laws, rules, regulations, codes) factors all influence health behaviour (Sallis *et al.*, 2015). Previous systematic reviews (Vancampfort et al., 2013b & 2015d) demonstrated that among people with affective disorders, significant correlates were found in six of the seven categories (excluding the policy level) of the socio-ecological model supporting the hypothesis that physical activity participation is a complex behaviour determined by many factors. The current evidence indicates that behaviour change theories used in the general population, such as the self-determination theory (SDT) appear to be applicable for individuals with affective disorders (Vancampfort et al., 2015h). ***While most behaviour change theories are not able to explain motives why individuals adopt an active lifestyle or remain sedentary, nor are they able to identify the mechanisms that underlie the maintenance of specific behaviours, the SDT examines the differential effects of qualitatively different types of motivation that can underlie a specific behaviour (Deci and Ryan, 2000). The SDT may provide insight into reasons why people with affective disorders commence and continue certain health behaviours. The theory proposes motivation is multidimensional and resides along a continuum. The lowest end of the***

continuum is identified as amotivation which represents a general lack of motivation to change behaviour due to discouragement. Following along the continuum, external regulation refers to being physically active or exercising to avoid punishment or criticism or to obtain promised rewards or external appreciation. Introjected regulation refers to the imposition of pressures onto one's own functioning, for instance, by reinforcing one's activity engagement with feelings of guilt, self-criticism, or contingent self-worth. More volitional (or autonomous) forms of functioning include identified regulation, which involves foreseeing the personal importance of physical activity or exercise, and integrated regulation, which implies that physical activity or exercise is brought in harmony with other prevailing life values, such that being active becomes prioritised within one's lifestyle. Finally, intrinsic motivation involves engaging in physical activity or exercise for its own sake, that is, because one finds being active stimulating or enjoyable by itself. Recently it was demonstrated in a cross-sectional study that people with affective disorders have higher levels of introjected regulations than people with other severe mental illnesses (such as schizophrenia) (Vancampfort et al., 2015i). It might be that people with affective disorders experience more feelings of guilt or shame when they do not comply with physical activity demands they pose themselves or which are posed to them by significant others. Large-scale effectiveness trials in real-world settings and comparative effectiveness studies of motivational strategies in people with affective disorders are urgently needed. Implementation of evidence-based behaviour change interventions is a critical step in achieving the goals of better quality, improved outcomes, and reduced costs of care. For example future large-scale effectiveness trials in real-world settings could explore whether assisting people with affective disorders in fulfilling three universal, psychological needs: (a) the need for autonomy (i.e., experiencing a sense of psychological freedom when engaging in exercise), (b) the need for competence (i.e., ability to attain desired outcomes following the exercise program), and (c) the need for relatedness (i.e., being socially connected when being physically active) increases the likelihood that people with affective disorder to maintain an active lifestyle, as has been seen in the general population (Deci and Ryan, 2000). In table 1, a brief overview of strategies used to fulfil these psychological needs is presented.

Funding is required for physical activity interventions to elucidate metabolic outcomes

Whilst there is substantial evidence for physical activity to prevent and manage metabolic disease in the general population, the literature is still in its infancy in affective disorders. There is an urgent need for funding for interventions to seek to prevent and manage cardio-metabolic outcomes. The limited available literature has considerable methodological limitations including small sample sizes, heterogeneous treatment groups, no control interventions, no distinction between types of physical activity (structured exercise versus lifestyle physical activity or aerobic versus resistance training), no clear definitions of the dose (frequency, intensity, time) and lack of comparisons between different stages of disease (mania, depression, remission), specific symptoms (psychosis, suicidality) or drug treatments (antidepressants, neuroleptics, lithium) (Vancampfort et al., 2016i). Therefore, first of all, large-scale intervention and longitudinal studies should be funded in order to determine the optimal physical activity prescription for preventing or treating cardio-metabolic abnormalities in people with affective disorders. Studies directly comparing physical activity prescriptions with each other are needed. The main components of physical activity prescription are the frequency, intensity, type and time. Each of these components can be manipulated to determine its effects on a given cardio-metabolic outcome. Once optimal physical activity prescriptions are defined, research will be essential to determine the most effective strategies for assisting people with affective disorders in adopting and maintaining healthy physical activity levels. For example, there is a need to fund interventions targeting the underpinning psychological mediators of behaviour change that may result in physical activity interventions being more effective. Incorporating mediator analyses into future research will also help confirm if any action, or conceptual theory links exist between theoretical frameworks and desired cardio-metabolic outcomes. Next to this, effective technologies for changing physical activity and sedentary behaviour such as online interventions and mobile phones applications are understudied in people with affective disorders (Rosenbaum *et al.*, 2015). In a previous survey of mobile health acceptability (Firth *et al.*, 2015), the majority of people with mental illness responded in favour of using mobile phones to enhance contact with services and support self-management. Considering the increasing availability of mobile phones and the acceptability of mobile health among patients, there is now a need to develop and evaluate mobile and online physical activity interventions to enhance healthcare services for people with affective disorders. Third, once the efficacy and effectiveness of physical activity interventions are well established in well-equipped scientific settings with research staff trained in physical activity prescription, the final step will be to fund interventions

and initiatives to translate research findings into "real-world" settings while exploring its cost-effectiveness. In order to justify the inclusion of physical activity programs as a routine component of treatment of metabolic disturbances in people with affective disorders, cost-benefit analyses are required in order to determine and quantify the financial implications of diverting resources or investing funds into such initiatives. Such economic rationales must aim to include cost-savings associated with prevention in the context of the treatment of cardio-metabolic comorbidities and ideally also potential benefits regarding preventing future episodes of poor mental health as well. Therefore, next to intervention and longitudinal studies exploring the efficacy of physical activity programs, effectiveness research capable of driving practice change, along with policy level research is urgently required.

Conclusions

Physical activity assessment and promotion should form an integral part of the management of people with affective disorders to improve health, well-being and prevent and manage cardio-metabolic outcomes. Whilst the evidence base is considerable in this regard in the general population, it is in its infancy in the prevention and management of cardio-metabolic abnormalities in affective disorders. There is a need for funding and future studies to develop the evidence base. In practice, physical activity should be considered a vital sign routinely and all patients encouraged to sit less and move more. Inclusion of physical activity programs and facilitating easy access facilities is warranted within all mental health care services. Physical activity as a viable and accepted component of usual care within mental health settings will be enhanced by more methodologically rigorous clinical research focusing not only on the efficacy (i.e., dose-response relationship), but also on its effectiveness (i.e., how people with affective disorders may include physical activity in their daily lives) and ultimately its cost-effectiveness.

References

American College of Sports Medicine, Anderson, H.D., Pace, W.D., Libby, A.M., West, D.R. & Valuck, R.J., 2012. Rates of 5 common antidepressant side effects among new adult and adolescent cases of depression: a retrospective US claims study. *Clinical therapeutics,* 34**,** 113-123.

Anon, 2009. *ACSM's Guidelines for Exercise Testing and Prescription. V,* 8th ed. Philadelphia: Lippincott Williams & Wilkins.

Bauer, I.E., Gálvez, J.F., Hamilton, J.E., Balanzá-Martínez, V., Zunta-Soares, G.B., Soares, J.C. & Meyer, T.D., 2016. Lifestyle interventions targeting dietary habits and exercise in bipolar disorder: a systematic review. *Journal of Psychiatric Research,* 74**,** 1-7.

Biswas, A., Oh, P.I., Faulkner, G.E., Bajaj, R.R., Silver, M.A., Mitchell, M.S. & Alter, D.A., 2015. Sedentary time and its association with risk for disease incidence, mortality, and hospitalization in adults: a systematic review and meta-analysis. *Annals of Internal Medicine,* 162**,** 123-132.

Caemmerer, J., Correll, C.U. & Maayan, L., 2012. Acute and maintenance effects of non-pharmacologic interventions for antipsychotic associated weight gain and metabolic abnormalities: A meta-analytic comparison of randomized controlled trials. *Schizophrenia Research,* 140**,** 159-168.

Cart, L., 2012. Standardized use of the terms "sedentary" and "sedentary behaviours". *Applied Physiology Nutrition and Metabolism,* 37**,** 540-542.

Caspersen, C.J., Powell, K.E. & Christenson, G.M., 1985. Physical activity, exercise, and physical fitness: definitions and distinctions for health-related research. *Public Health Reports,* 100**,** 126.

Cornelissen, V.A., Fagard, R.H., Coeckelberghs, E. & Vanhees, L., 2011. Impact of resistance training on blood pressure and other cardiovascular risk factors a meta-analysis of randomized, controlled trials. *Hypertension,* 58**,** 950-958.

Correll, C., Detraux, J., De Lepeleire, J. & De Hert, M., 2015. Effects of antipsychotics, antidepressants and mood stabilizers on risk for physical diseases in people with schizophrenia, depression and bipolar disorder. *World Psychiatry,* 14**,** 119-136.

Cuijpers, P. & Smit, F., 2002. Excess mortality in depression: a meta-analysis of community studies. *Journal of Affective Disorders,* 72**,** 227 - 236.

De Souto Barreto, P., 2015. Global health agenda on non-communicable diseases: has WHO set a smart goal for physical activity? *BMJ,* 350**,** h23.

Deci, E.L. & Ryan, R.M., 2000. The" what" and" why" of goal pursuits: Human needs and the self-determination of behavior. *Psychological inquiry,* 11**,** 227-268.

Firth, J., Cotter, J., Torous, J., Bucci, S., Firth, J.A. & Yung, A.R., 2015. Mobile Phone Ownership and Endorsement of "mHealth" Among People With Psychosis: A Meta-analysis of Cross-sectional Studies. *Schizophrenia Bulletin***,** sbv132.

Gibbons, R.J., Balady, G.J., Bricker, J.T., Chaitman, B.R., Fletcher, G.F., Froelicher, V.F., Mark, D.B., Mccallister, B.D., Mooss, A.N. & O'reilly, M.G., 2002. ACC/AHA 2002 guideline update for exercise testing: summary article: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Committee to Update the 1997 Exercise Testing Guidelines). *Journal of the American College of Cardiology,* 40**,** 1531-1540.

Goldstein, B.I., Carnethon, M.R., Matthews, K.A., Mcintyre, R.S., Miller, G.E., Raghuveer, G., Stoney, C.M., Wasiak, H. & Mccrindle, B.W., 2015. Major Depressive Disorder and Bipolar Disorder Predispose Youth to Accelerated Atherosclerosis and Early Cardiovascular Disease A Scientific Statement From the American Heart Association. *Circulation,* 132**,** 965-986.

Grant, R.W., Schmittdiel, J.A., Neugebauer, R.S., Uratsu, C.S. & Sternfeld, B., 2014. Exercise as a vital sign: a quasi-experimental analysis of a health system intervention to collect patient-reported exercise levels. *Journal of general internal medicine,* 29**,** 341-348.

Green, C.A., Yarborough, B.J.H., Leo, M.C., Stumbo, S.P., Perrin, N.A., Nichols, G.A. & Stevens, V.J., 2015. Weight maintenance following the STRIDE lifestyle intervention for individuals taking antipsychotic medications. *Obesity*.

Greenwood, J.L., Joy, E.A. & Stanford, J.B., 2010. The Physical Activity Vital Sign: a primary care tool to guide counseling for obesity. *Journal of Physical Activity & Health,* 7**,** 571-6.

Happell, B., Stanton, R., Hoey, W. & Scott, D., 2014. Cardiometabolic Health Nursing to Improve Health and Primary Care Access in Community Mental Health Consumers: Baseline Physical

Health Outcomes from a Randomised Controlled Trial. *Issues in mental health nursing,* 35**,** 114-121.

Hayes, J., Miles, J., Walters, K., King, M. & Osborn, D., 2015. A systematic review and meta-analysis of premature mortality in bipolar affective disorder. *Acta Psychiatrica Scandinavica,* 131**,** 417-425.

Holt, R.I.G. & Mitchell, A.J., 2014. Diabetes mellitus and severe mental illness: mechanisms and clinical implications. *Nature Reviews Endocrinology*.

Janney, C.A., Fagiolini, A., Swartz, H.A., Jakicic, J.M., Holleman, R.G. & Richardson, C.R., 2014. Are adults with bipolar disorder active? Objectively measured physical activity and sedentary behavior using accelerometry. *Journal of Affective Disorders,* 152**,** 498-504.

Jewell, L., Abtan, R., Scavone, A., Timmins, V., Swampillai, B. & Goldstein, B.I., 2015. Preliminary evidence of disparities in physical activity among adolescents with bipolar disorder. *Mental Health and Physical Activity,* 8**,** 62-67.

Kahl, K., Kerling, A., Tegtbur, U., Gützlaff, E., Herrmann, J., Borchert, L., Ates, Z., Westhoff-Bleck, M., Hueper, K. & Hartung, D., 2016. Effects of additional exercise training on epicardial, intra-abdominal and subcutaneous adipose tissue in major depressive disorder: A randomized pilot study. *Journal of affective disorders,* 192**,** 91-97.

Kemp, D.E., 2014. Managing the side effects associated with commonly used treatments for bipolar depression. *Journal of affective disorders,* 169**,** S34-S44.

Kessing, L.V., Vradi, E. & Andersen, P.K., 2015. Life expectancy in bipolar disorder. *Bipolar disorders,* 17**,** 543-548.

Laursen, T.M., Musliner, K.L., Benros, M.E., Vestergaard, M. & Munk-Olsen, T., 2016. Mortality and life expectancy in persons with severe unipolar depression. *Journal of Affective Disorders,* 193**,** 203-207.

Laursen, T.M., Wahlbeck, K., Hällgren, J., Westman, J., Ösby, U., Alinaghizadeh, H., Gissler, M. & Nordentoft, M., 2013. Life expectancy and death by diseases of the circulatory system in patients with bipolar disorder or schizophrenia in the Nordic countries. *PLoS One,* 8**,** e67133.

Leucht, S., Cipriani, A., Spineli, L., Mavridis, D., Orey, D., Richter, F., Samara, M., Barbui, C., Engel, R.R., Geddes, J.R., Kissling, W., Stapf, M.P., Lassig, B., Salanti, G. & Davis, J.M., 2013. Comparative efficacy and tolerability of 15 antipsychotic drugs in schizophrenia: a multiple-treatments meta-analysis. *Lancet,* 382**,** 951-62.

Lin, X., Zhang, X., Guo, J., Roberts, C.K., Mckenzie, S., Wu, W.C., Liu, S. & Song, Y., 2015. Effects of Exercise Training on Cardiorespiratory Fitness and Biomarkers of Cardiometabolic Health: A Systematic Review and Meta-Analysis of Randomized Controlled Trials. *Journal of the American Heart Association,* 4**,** e002014.

Mcginty, E.E., Baller, J., Azrin, S.T., Juliano-Bult, D. & Daumit, G.L., 2015. Quality of medical care for persons with serious mental illness: a comprehensive review. *Schizophrenia research,* 165**,** 227-235.

Naci, H. & Ioannidis, J.P., 2013. Comparative effectiveness of exercise and drug interventions on mortality outcomes: metaepidemiological study. *BMJ* 347**,** f5577.

Pratt, S.I., Jerome, G.J., Schneider, K.L., Craft, L.L., Buman, M.P., Stoutenberg, M., Daumit, G.L., Bartels, S.J. & Goodrich, D.E., 2016. Increasing US health plan coverage for exercise programming in community mental health settings for people with serious mental illness: a position statement from the Society of Behavior Medicine and the American College of Sports Medicine. *Transl Behav Med*.

Prochaska, J.O. & Diclemente, C.C., 1992. Stages of change in the modification of problem behaviors. *Progress in behavior modification,* 28**,** 183.

Rosenbaum, S., Newby, J.M., Steel, Z., Andrews, G. & Ward, P.B., 2015. Online physical activity interventions for mental disorders: A systematic review. *Internet Interventions,* 2**,** 214-220.

Sallis, R., Franklin, B., Joy, L., Ross, R., Sabgir, D. & Stone, J., 2015. Strategies for promoting physical activity in clinical practice. *Progress in cardiovascular diseases,* 57**,** 375-386.

Sigal, R.J., Purdon, C., Bilinski, D., Vranic, M., Halter, J.B. & Marliss, E.B., 1994. Glucoregulation during and after intense exercise: effects of beta-blockade. *The Journal of Clinical Endocrinology & Metabolism,* 78**,** 359-366.

Soundy, A., Stubbs, B., Probst, M., Hemmings, L. & Vancampfort, D., 2014. Barriers to and facilitators of physical activity among persons with schizophrenia: A survey of physical therapists. *Psychiatric Services,* 65**,** 693-696.

Stanton, R., Happell, B., Hayman, M. & Reaburn, P., 2014. Exercise interventions for the treatment of affective disorders - research to practice. *Frontiers in Psychiatry,* 5.

Stanton, R., Reaburn, P. & Happell, B., 2013. Is Cardiovascular or Resistance Exercise Better to Treat Patients With Depression? A Narrative Review. *Issues in mental health nursing,* 34**,** 531-538.

Stubbs, B., Eggermont, L., Mitchell, A.J., De Hert, M., Correll, C.U., Soundy, A., Rosenbaum, S. & Vancampfort, D., 2015. The prevalence of pain in bipolar disorder: a systematic review and large-scale meta-analysis. *Acta Psychiatrica Scandinavica,* 131**,** 75-88.

Stubbs, B., Probst, M., Soundy, A., Parker, A., De Herdt, A., De Hert, M., Mitchell, A.J., Vancampfort, D. & Health, T.I.O.O.P.T.I.M., 2014. Physiotherapists can help implement physical activity programmes in clinical practice. *The British Journal of Psychiatry,* 204**,** 164.

Stubbs, B., Vancampfort, D., Rosenbaum, S., Ward, P.B., Richards, J., Soundy, A., Veronese, N., Solmi, M. & Schuch, F.B., 2016a. Dropout from exercise randomized controlled trials among people with depression: A meta-analysis and meta regression. *Journal of affective disorders,* 190**,** 457-466.

Stubbs, B., Vancampfort, D., Rosenbaum, S., Ward, P.B., Richards, J., Soundy, A., Veronese, N., Solmi, M. & Schuch, F.B., 2016b. Dropout from exercise randomized controlled trials among people with depression: A meta-analysis and meta regression. *J Affect Disord,* 190**,** 457-66.

Stubbs, B., Williams, J., Gaughran, F. & Craig, T., 2016c. How sedentary are people with psychosis? A systematic review and meta-analysis. *Schizophrenia Research*.

Thornicroft, G., 2011. Physical health disparities and mental illness: the scandal of premature mortality. *Br J Psychiatry.,* 199**,** 441-2.

Vancampfort, D., De Hert, M., Skjerven, L., Gyllensten, A., Parker, A., Mulders, N., Nyboe, L., Spencer, F. & Probst, M., 2012a. International Organization of Physical Therapy in Mental Health consensus on physical activity within multidisciplinary rehabilitation programmes for minimising cardio-metabolic risk in patients with schizophrenia. *Disability and rehabilitation,* 34**,** 1-12.

Vancampfort, D. & Faulkner, G., 2014. Physical activity and serious mental illness: A multidisciplinary call to action. *Mental Health and Physical Activity,* 3**,** 153-154.

Vancampfort, D., Knapen, J., Probst, M., Scheewe, T., Remans, S. & De Hert, M., 2012b. A systematic review of correlates of physical activity in patients with schizophrenia. *Acta Psychiatrica Scandinavica,* 125**,** 352-362.

Vancampfort, D., Rosenbaum, S., Probst, M., Connaughton, J., Plessis, C.D., Yamamoto, T. & Stubbs, B., 2016a. Top 10 research questions to promote physical activity in bipolar disorders: A consensus statement from the International Organization of Physical Therapists in Mental Health *Journal of Affective Disorders*.

Vancampfort, D., Rosenbaum, S., Schuch, F., Ward, P.B., Richards, J., Mugisha, J., Probst, M. & Stubbs, B., 2016. Cardiorespiratory Fitness in Severe Mental Illness: A Systematic Review and Meta-analysis. *Sports Med*.

Vancampfort, D., Stubbs, B., Mitchell, A.J., De Hert, M., Wampers, M., Ward, P.B., Rosenbaum, S. & Correll, C.U., 2015a. Risk of metabolic syndrome and its components in people with schizophrenia and related psychotic disorders, bipolar disorder and major depressive disorder: a systematic review and meta-analysis. *World Psychiatry,* 14**,** 339-347.

Vancampfort, D., Stubbs, B., Ward, P., Teasdale, S. & Rosenbaum, S., 2015b. Integrating physical activity as medicine in the care of people with severe mental illness. *Australian and New Zealand Journal of Psychiatry,* 49**,** 681–682.

Vancampfort, D., Stubbs, B., Ward, P.B., Teasdale, S. & Rosenbaum, S., 2015c. Why moving more should be promoted for severe mental illness. *The Lancet Psychiatry,* 2**,** 295.

Wilmot, E.G., Edwardson, C.L., Achana, F.A., Davies, M.J., Gorely, T., Gray, L.J., Khunti, K., Yates, T. & Biddle, S.J., 2012. Sedentary time in adults and the association with diabetes, cardiovascular disease and death: systematic review and meta-analysis. *Diabetologia,* 55**,** 2895-2905.

Wulsin, L.R., Vaillant, G.E. & Wells, V.E., 1999. A systematic review of the mortality of depression. *Psychosomatic medicine,* 61**,** 6-17.

Ösby, U., Westman, J., Hällgren, J. & Gissler, M., 2016. Mortality trends in cardiovascular causes in schizophrenia, bipolar and unipolar mood disorder in Sweden 1987-2010. *European Journal of Public Health*.

Table 1. Overview of motivational strategies to improve adherence to physical activity in people with affective disorders

1. Develop physical activity interventions based on the person's current preferences and expectations and the initial metabolic risk profile and physical activity assessment.
2. Assist in developing an individual action plan taking into account barriers people with affective disorders are confronted with.
3. Assist the person in setting specific, measurable, achievable, realistic, time-bound and rewarding goals which lead to success experiences.
4. Adapt the progression taking into account the individual's metabolic health status and physical abilities, age, aerobic and metabolic status, physical activity history, expectations and goals, side-effects of psychotropic medication, and perceived exertion.
5. Use cognitive-behavioural strategies such as self-monitoring, stimulus cuing, goal-setting, and contracting. For example, provide exercise cards and a logbook and use regular progress feedback.
6. Avoid between-peers comparisons but stimulate enjoyable social interactions.
7. Emphasize the short-term benefits after single aerobic exercise sessions: improvements in mood and energy level and reductions in state anxiety, stress levels, distraction of negative thoughts, and the ability to concentrate and focus. Physical activity can give people with affective disorders a sense of power over their recovery.
8. Facilitate autonomous reasons for participation as possible by focusing on the positive experiences of physical activity itself.

Table 1. Continued

9. Start focusing on perceived aerobic and metabolic fitness gains, achievement of personal goals and mastery experiences once the person is active for several weeks

10. Discuss problem-solving around barriers, reinforce all progress toward change (even if initially very small progress has been made), and encourage modification of goals if needed.
11. Seek support of others such as family and friends.
12. Use relapse behaviours/strategies: it is important to explain to persons with affective disorders that relapses are part of the process of change, and that responding with guilt, frustration, and self-criticism may decrease their ability to maintain physical activity. Relapse prevention strategies such as realistic goals setting, planned activity, realistic expectations, identifying and modifying negative thinking, and focusing on benefits of single physical activity sessions seem to be effective.

Highlights

- Physical activity should be considered a vital sign.
- Qualified exercise professionals should be key members of the multidisciplinary team.
- Physical activity interventions should incorporate behavioural theories.
- Research should focus on the efficacy and (cost-) effectiveness of physical activity for reducing metabolic risk.